

SYMPOSIUM ON INTEGRATED APPLICATIONS (B5)
Integrated Applications End-to-End Solutions (2)

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HOW CAN SENTINEL-2 IMAGES ASSIST HUMANITARIAN ACTIONS TO HELP REDUCE
CALAMITIES ON THE SEA?

Abstract

The process of migration by sea is often accompanied by a great deal of risk for the migrants. The need for reliable and on time information on migrant movements is essential, especially as the available information is often limited or inconsistent. The aim of this paper is to show how freely available Sentinel-2 optical images over large areas could support humanitarian actions with timely and accurate geospatial information by providing exact location of vessels on the sea at the time of satellite acquisition. With the proposed detection method we would like to distance ourselves from border surveillance and fight against clandestine migration as the first associations when dealing with movements of people using satellite technology. Instead we would like to provide a better understanding of the situation for relieve authorities.

Using Sentinel-2 data we have developed an automatic vessel detection and classification procedure. By first removing land from the images with the use of Modified Normalized Difference Water Index (MNDWI) we obtained a sea mask. We then applied a so-called “vessel index” on this mask to obtain segments of possible vessels. This index eliminates most of the atmospheric influences that can significantly weaken the detection results from optical images except dark areas of cloud shadows, which produce, if present on the image, the highest amount of false alarms. We calculated a group of geometrical, spectral and texture attributes of detected segments and have based on these attributes removed all the non-vessel segments in a discrimination step. Later we developed a spectral library of different types of vessels, which acts as a sample input for classification approach. Finally, we performed an accuracy assessment that shows vessels can be detected with proposed automatic procedure with 86% accuracy. The results also demonstrate that the methodology gives reliable outcome in a timely and consistent manner. Freely available satellite technology can therefore offer an efficient and effective solution for frequent monitoring and tracking of vessels in real time across large areas. This approach can be complementary to other methods that deal with migrant movements to help reduce the intolerable death toll of migrants while crossing the sea.